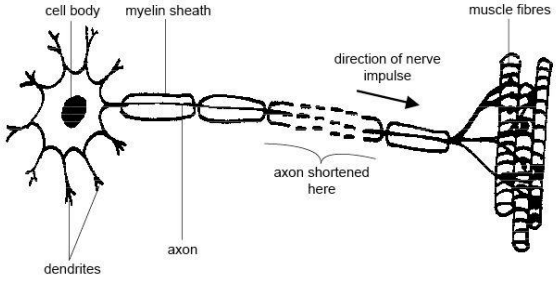
junctions and synapses

as it is shown here a typical neuron motor with its parts clarified on



the direction of the electrical signal is from the dendrites through the axon till the muscle fibers, we have one of the terminals of the neuron is called axon, this axon will branches to give many others areas this is the way of communication, the connection between other cells and neuron cells is called conversions while the bifurcation of the axon to other sources we call it diversion

there is graded potential at the level of soma and the level of dendrite and we usually take the algebraic sum , there will be mutual cancellation between excitation and inhibition and the end result if it arrives to axon hallow which contain 7 times more sodium voltage gated channel than any other part of this neuron when fire an action potential , by the axon there will be action potential

today we are going to ask our self ,when the action potential reaches the end , what is going to happen ?

the connection between different neurons and non neural structures we have something we call it synapses and junctions what is the difference ? both are connection to an excitable tissue; but **junction** is existed in between neuron and non-neural structure; could be muscle skeletal or smooth "neuromuscular junction" but synapses means connections between neural and another neural structures connection(not necessary to be full neuron , could be axon with dendrites,,,)

we are studying the physiology of the junction and synapses and see what are their effect on our wellbeing mood inelegance and whatever our brain perform.

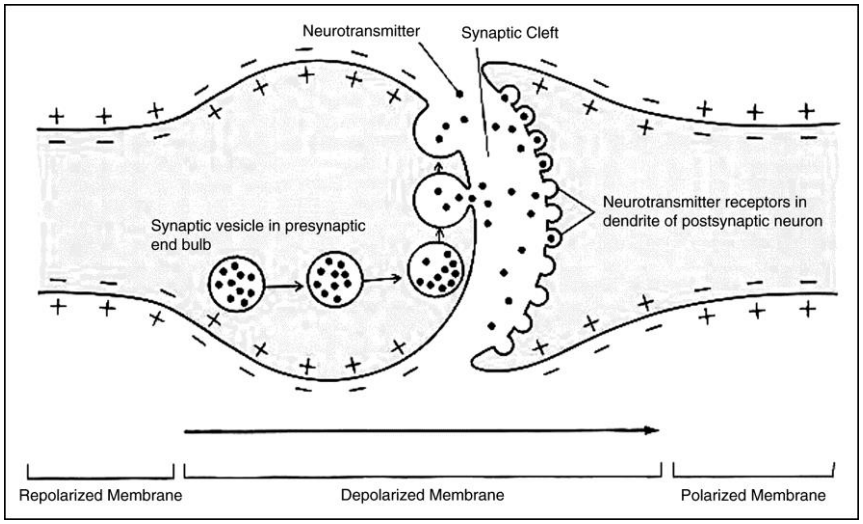
how many different types of synapses we have ? the answer is two; one is electrical synapses or the gap junction major criteria of the gap-junction is that there is an opening between the adjacent cells so the ion can pass freely in both sides this is present in the heart and is so

important because the heart works in synsetum which means ; in order to the heart to contract and pump blood you need at the same moment all the myocardial muscles fibers to contract together therefore you need this type of electrical connection , where the direction of connection goes in all different ways

do you think we need this type in out brain ? we have 99.9% of the synapses in our brain are chemical and a very little amount of its synapses electrical only in the smell sensation and this is primitive and we are really much less sensitive to smells if we compared our self to others animals , so for human it is very primitive type of function to us but it is usually used by animals in seeking food shelter or run from enemy ,it's not life changing function that's why is primitive type of activity we have

the **chemicals** is characterized by it is unidirectional ; no retain of information to the other side that's why our brain is so sophisticated and organized and he know exactly which part connected to other side

as it shown here, you can see the synapse and the synaptic cleft or a gap a space



synaptic cleft "no direct connections no adherence between the neural structures , in order to release the neurotransmitter chemical substance and activate the other neuron so we here have a gap and a chemical substance to be released and to have highly specific receptor for them on the other side.

what do we need for this terminal to release these chemicals? ca+ and action potential

#**action potential** has to arrive to the terminal leading to opening the voltage gated **ca+ channel** and ca+ influx the calcium influx will assist the vesicles here that contain the neurotransmitter to be released.

if we want to investigate synapses the brain it's a very difficult obtained why ?as they **have to break the skull** and **isolate the synapses** its very time consuming expensive and very difficult research wise so they came to the conclusion that the neuromuscular junction is the beautiful model to study all the synapses.

one of the reasons other than its difficult to obtain the synapses from the brain that we have 150 chemicals substances that are playing in our head at the single moment 50 of them are well known in neuro transmetters or nuero modulator that's change our way of thinking mood behavior sleep and so many other thing

which make it more difficult that to know; each neuron in our brain contains at least two or three neurotransmitters which make it more difficult to study these synapses.

why we use the nuro-muscular junction?

عفية!

1# it's easy accessible; if you take a mouse if you cut the skin on the anterior thigh muscle remove the subcutaneous fat and you see the neuromuscular junction

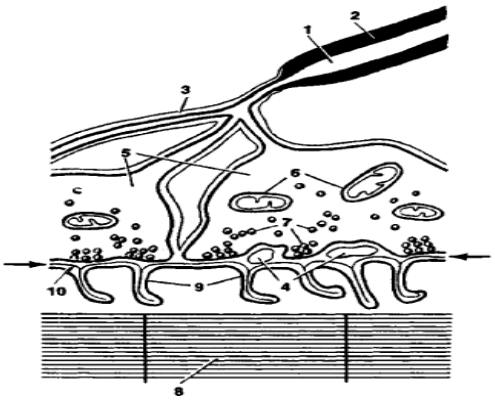
2# easy to investigate

3# less expensive

4# easy to study ;that all skeletal muscles in our body only secretes acetyl collin while in the brain we have 150 different chemicals substances with different functions some we know and other we don't

knowing in any area there a lot of mitochondria that's means that is highly active! , which is the terminal end of the nerve. because we use our skeletal muscles alot so its very important for it to be highly activated.

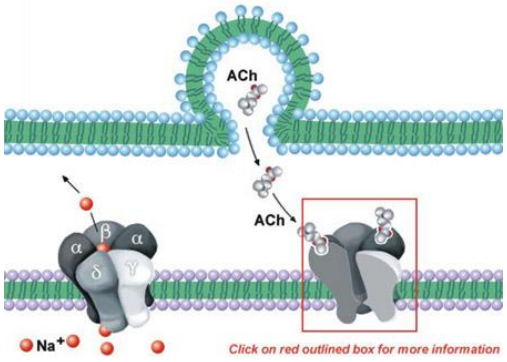
we have these the vesicles only contain acetyl collin as shown ,so what is needed to release these vesicles ?



first we need **action potential** that has to arrive to the terminal and then we need **ca+ influx** through ca+ channels to the inside once ca+ enters then you are going to put calcium to certain protein "calmoduolents" then moves the vesicles up to the peripheral then the vesicles will rupture , there are going to be alot of acetyl collin molecule released in the cleft ,

"there are 150 vesicles contains acetyl collin which goes up to 10'000 types so we are talking about millions of acetyl collin thats why we never fail to contract a muscle if we are healthy"

so now where it is released ? its going to get attached to specific receptors on the highly specific area on a skeletal muscle we call it end plate this type of channel will open it is called the acetyl collin receptor because it needs acetyl choline to sit on it in order to be opened



each of these receptor contains binding receptor to the 2 molecules ,knowing that it is negative from the inside so it will attract positive ions from the outside na+ will inter which will lead to the end plate potential which is a graded potential , upon reaching threshold it will create action potential which will spread through the hole muscle so after that the muscle will contract due to a mechanism which will talk about later .

so here it's the end plate potential stage which is a kind of graded potential , from where the acetyl choline synthesized ?at the terminal with the help of mitochondria and the choline

which come back with the acetyl coA which will combine to form the acetyl choline molecule which will be held in the vesicle which will stay in its place until the action potential comes and it is release

if it the acetyl choline stays long time we are going through a spasm without any relaxation of the muscles , so what ends its function ? an enzyme which is located in the muscles it is called acetyl choline esterase ,the enzyme that terminate acetyl choline and the neural muscular junction starts freshly with a new receivance of a new action potential and starts a new action

there is another enzyme we call it transferase enzyme to the synthesis of acetyl choline its in the neuron it is used before the break down of acetyl choline ,and esterase enzyme on the muscles

synthesize acetyl choline is broken into choline and acetate by the esterase choline will be uptaken and used again to synthesize acetyl choline and the acetate will be disapetit .another enzyme the transference in the nerve which combine choline and acetyl again

if you are researcher and given the model the neuro muscular junction model, i told you before it is similar to synapses the only difference that it is more complicated than this if I want you to create anti epilepsy drug? what you need to create something can help these patients ?

"you can't change the intracellular enzyme or origin without interfere the whole cell "

-**#1block ca+ channels** , **#2stop action potential** ,**#3increase the choline esterese activity**

one of the few of the substances that the pharmacy company earn alot of money from manufacturing " **Botulinum toxin** "

it prevent the acetyl choline release , by toxin called Botulinum toxin by specific bacteria that present in badly canned food so diluted and controlled amount of this toxin concentration can be used in medicine aspects , it is used for relaxation of muscles

this is a research mind changes bad to good thing !

""an advice for the expatriate المغترب dont eat from rusty or badly canned food , you will die .due to this bacteria it release toxin which attack acetyl choline which could paralyze your muscles "

muscle relaxation is needed in many of the spasms that affect athletes when they play sports and in many certain disorder with the brain he goes "hestastic" - i am not sure if it is spelled like this - so the patient need to relax in muscles ,when the patient need abdominal procedures the doctor cannot open before getting the muscles a relaxation

Botulinum toxin has been used in the last 15 years ,companies are getting billions out of it its usage the botox; it Paralysis the facial muscles so we use it to remove wrinkles

don't underestimate it , it helped a lot of kids sequin حوَل one of the muscles are strong the other is weak so we inject the strong one and paralyze it partially and who is suffering the irritable bladder need to go to the WC every 50 minute we inject there bladder to wait 2-3 hours , its distressing to the person ,

cervical dystonia patients so we give him the injection of the botox , neuro spasm making its hard to open eyes with constant blinking involuntary so we inject him as well , severe sweating people we treat them by injecting them with botox in the axilla ,all of these sickness are treated by the botox injections .but (it is a temporarily treatment the botox)

treating headache or stress people so it's not for cosmetic operation only!

"" for girls dont put botex unless it is given with a goo hand from a knowledgeable person with a lot of experience ,because its a toxin which could if given in high doses making your face dropping breath and swallowing difficulties so it could be dangerous

competitive antagonist , agonist :-

when we say competitive it means it compete with the natural substance which is presented in the body in this case it the acetyl choline so there are substance compete it in there receptors so they simple take its place without doing anything so no functioning because they dont do the work they dont open the gates of the channels so **she** just sit there without doing anything !

"detuocori" this is a plan that has been used by Indian in hunting people and animals , they use to put their arrows in the decoction (when you plant to sock them in water and get its component) they put the arrows in it over night , so what does it do ?it temporarily paralyze

the muscles by these competitive substances in the arrows so the animal can't move its muscles and it becomes easy to hunt.

now a day we use it as a muscles relaxation in abdominal surgeries curary **

i have discussed 2 different ways of really affecting the physiology of synapses or neuro muscular junction one by inhibiting the acetyl choline release by botox , by competitive antagonist to acetyl choline ,

for all who study well will graduate ,if you want to become special physicians so you need to have a researcher mind

what if we inhibit cholinee esterase enzyme? two scientist did that in each their own way ; one of them has created a weapon that " diisopropyl fluorophosphate "the nerve gas" it kept acetyl choline to work indefinitely this thing has no antidote no treatment ! so its immediate death.

the other one did completely the opposite , myasthenia gravis patient now had a treatment because of him

mistinvia gravis infect young female making them not capable of moving their upper limb with its complete strength so they cannot move it freely making then unable to do simple thing like Combing their hair ;very week muscles because of their immune system which form an antibody to destroys the acetyl choline receptors so they though if we can inhibit the effect of choline esterin for a short period we can prolong the availability of acetyl choline for this little amount of receptors in those patients " neostigmine " or fibo stegmen (any drug its name ends with -stegmen) a drug stop the choline esterase, it is also use for diagnoses and treatment , a young female when injected it can moves and open her eyes like a miracle to her but unfortunately its a temporal treatment for 6 hours and then she needs another dose " myasthenia grips " the disease name .

by the way i have asked the doctor and she said all of these diseases names should be memorized

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good luck :-)